REMARKS

This amendment is responsive to the Official Action dated April 23, 2003.

Claims 45-72 were pending in the application.

No claims were allowed.

By way of this amendment, the Applicant has submitted a replacement drawing sheet 19 showing an amendment to Fig. 21, and amended several of the claims to correct antecedent issues identified by the Applicant.

Accordingly, claims 45-72 are currently pending in the application.

Brief Discussion of the Invention:

Before discussion the claim rejections, a review of the inventive subject matter is believed to be in order. The claimed inventions in this application address a problem that can occur in the packaging of VCSELs and other surface normal optoelectronic devices that has not been addressed in the prior art. One of the major advantages of VCSELs as lasers is the fact that they can be tested and characterized on-wafer to determine their suitability for packaging. This can be a great cost advantage.

Unfortunately, some packaging procedures, such as solid material encapsulation, necessarily change the device characteristics of typical VCSELs, making it difficult to predict the performance of packaged devices from the on-wafer performance. The Examiner should note that the term encapsulation as used within the present specification is intended to mean a solid optically transmissive encapsulation material that is molded over the VCSEL device. The changes in the device characteristics that occur when encapsulated, occur as a result of the interface between the surface of the VCSEL and the surface of the encapsulation material rather than air. An encapsulation material or encapsulation material as claimed, is not the same as a TO can package. A TO can package would be hermetically sealed, not encapsulated, and would have a VCSEL/air interface. There is no encapsulant material within a TO can package.

Continuing with the noted limitation that the device is encapsulated, a question then arises. Can the devices be fabricated in such a way as to make the on-wafer performance the

same as the packaged (encapsulated) performance? This application presents a totally non-obvious affirmative answer to that question. *Surprisingly, the deposition of a pre-calculated thickness of just one extra layer of optically transparent material, atop the VCSEL, can adjust the reflectivity of the top VCSEL mirror, so as to make the on-wafer performance the same as the packaged performance.* The Examiner should also note that the encapsulation medium matching layer is deposited onto the VCSEL structure, i.e. it is part of the VCSEL layer structure, and thus not equivalent to an optical window as part of a TO can.

Drawing Objection:

The drawings were objected to as lacking designations for --PRIOR ART--. No specific Figures were identified by the Examiner. Upon review of the specification and drawings, the Applicant has amended Fig. 21 to include the proper PRIOR ART legend. No other drawings are believed to represent prior art.

No new matter has been added.

Review and consideration of the substitute drawing sheets is respectfully solicited.

Claim rejections under 35 USC §102:

Claims 45-50 were rejected under 35 USC §102(b) as being anticipated by Gilliland et al ('582).

As a basis for the rejection, the Examiner stated the following:

> *"With respect to claim 45, Gilliland et al disclose an optoelectronic device assembly (14), optoelectronic device (20) comprising a substrate (26), an optical transparent encapsulation medium matching layer overlying said optoelectronic device, said medium matching layer having an index of refraction n1 substantially equal to an index of refraction n2 of an encapsulation medium (66) which is to encapsulate said optoelectronic device, and said medium matching layer having a predetermined thickness configured to adjust an optical characteristic of said optoelectronic device so as to make pre-encapsulation on-wafer, test characteristics of*

said optoelectronic device substantially similar to post encapsulation functional characteristics, note col. 4 line 24 to col. 7, line 65, see figs. 1-2.

With respect to claims 46-47, Gilliland et al disclose optoelectronic device (20) comprises a VCSEL (10) and the thickness of said medium matching layer (66) comprising a non-quarter wavelength thickness, note col. 4-7, see figs. 1-2.

With respect to claims 48-50, Gilliland et al disclose an encapsulated optoelectronic device assembly (14), optoelectronic device (20) comprising a substrate (26), an optically transmissive housing substantially encapsulating said optoelectronic device (20) includes VCSEL (10) wherein said housing (12) has an index of refraction n1, an optically transparent window (66) encapsulation medium matching layer overlying said optoelectronic device (20), medium matching layer comprises a non-quarter wavelength thickness, said medium matching layer having an index of refraction n1 substantially equal to said index of refraction n2 of said housing, said medium matching layer having a predetermined thickness configured to adjust an optical characteristics of said optoelectronic device so as to make pre-encapsulation on wafer, test characteristics of said optoelectronic device substantially similar to post encapsulation functional characteristic, note col. 4 line 23 to col. 10 line 6, see figs. 1-2. "

Applicant will agree that Gilliland discloses an optoelectronic device assembly (14), optoelectronic device (20) and a substrate (26). However, beyond that comparison, the claimed invention and Gilliland have nothing in common. Gilliland discloses a TO can package which is hermetically sealed. Hermetic sealing and encapsulation are two different packaging techniques and are unrelated. The Examiner then vaguely refers to the entire text of the Detailed Description as providing support for the limitations of a medium matching layer, when as far as the Applicant can tell, there is no such mention or discussion of the VCSEL layer construction or encapsulation at all in Gilliland. In fact Gilliland ignores the VCSEL construction as being well known in the art (See column 5, lines 62-64).

As indicated above, the present invention is directed to a VCSEL which is encapsulated with optically transparent material. Gilliland does not discuss such a packaging technique. The heart of the invention is directed to a modification of the VCSEL structure

required as a result of changes that occur in operation when the VCSEL is encapsulated in this material.

As far as can be determined from a reading of the Office Action, the Examiner has tried to equate the WINDOW 66 of Gilliland with both the encapsulation medium matching layer and the encapsulation medium as presently claimed. There are three separate references to the window 66 in the above-noted paragraphs (underlined for emphasis) as a basis for anticipating the medium matching layer, the encapsulation material, and/or both of the materials together. It is thus unclear what the Examiner is discussing and thus impossible to form arguments. As indicated above, the crux of invention centers on the use of the medium matching layer which is deposited as a layer within the VCSEL structure. The window 66 in Gilliland is part of the hermetic TO can housing and is not anticipatory of a layer of the VCSEL structure. The window 66 as disclosed in Gilliland is simply not the same type of structure, nor is it even remotely analogous. Gilliland makes no reference, explicit or implicit, that any of its teachings would be applicable to an encapsulated device as recited in the claims.

Since Gilliland does not disclose an encapsulated optoelectronic device, nor does it disclose a medium matching layer to compensate for such encapsulation, Gilliland cannot anticipate claims 45-50 as rejected. Reconsideration and allowance of the claims is respectfully solicited.

Claims rejections under 35 USC §103:

Claims 51-66 were rejected under 35 USC §103 as being obvious over Gilliland in view of Kopf ('441). Gilliland was applied as in the rejection of claims 45-50.

Claims 67-72 were rejected under 35 USC §103 as being obvious over Gilliland in view of Kopf ('441), and further in view of Yuang ('864).

For the reasons stated above, it is the Applicant's position that Gilliland does not anticipate or render obvious any of the structure related to the encapsulation medium matching layer, or encapsulating material. Accordingly, all of the §103 rejections based on Gilliland are no longer believed to be applicable.

Withdrawal of the Section 103 rejections, and review and reconsideration of claims 45-72 is respectfully solicited.

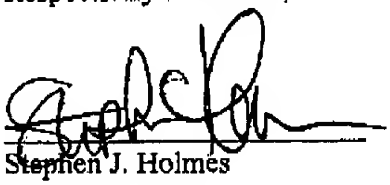
Accordingly, claims 45-72 are believed to define patentable subject matter in view of the prior art cited.

Claims 45-72 are thus believed to be in condition for allowance and the application now ready for issue.

Corresponding action is respectfully solicited.

PTO is authorized to charge any additional fees incurred as a result of the filing hereof or credit any overpayment to our account #02-0900.

Respectfully submitted,



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